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ABSTRACT

This paper examines the relationship between beginning reading and cognitive development and reviews some of the research conducted so far. It is noted that children learning to read may be in various stages of cognitive development, some at a preoperation stage, some at a concrete operation stage, and some at a transition stage. Instructional implications stemming from these stage characteristics are discussed in sections concerning the child's concept of reading and written language, the task of decoding, the knowledge and learning of vocabulary and concepts, and the comprehension of ideas as it relates to areas such as experiential background, making inferences, understanding figurative expression, and being alert to overall structure. Implications for instruction suggest that the teaching-learning situation is best approached by teachers who recognize individual differences in children's cognitive development, who inquire how children understand something, and who help them develop new cognitive strategies. (MKM)

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COGNITIVE DEVELOPMENT:

AN AREA WORTH STUDYING FOR

TEACHERS OF BEGINNING READING

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COGNITIVE DEVELOPMENT:
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Few would deny that reading involves thinking ability, that readers have to be thinkers. Neither can it be denied that both reading and thinking are developmental processes--that over time children's strategies increase and improve. Recent interest has been sparked in both the fields of reading and child study regarding the intersection of cognitive development and reading development. Particularly intriguing is the influence of cognitive factors on beginning reading because at the time children typically are introduced to reading instruction, they are experiencing significant cognitive changes. Important to a discussion of the cognitive-reading connection are several considerations: 1) the cognitive characteristics of beginning readers, 2) the cognitive skills required of children in beginning reading, and 3) the extent to which beginning readers have these skills. Necessarily flowing from a discussion are implications for research which are found at the end of this paper and implications for teaching found throughout.

A COGNITIVE DESCRIPTION OF YOUNG CHILDREN

Traditionally children are first exposed to reading instruction in the first grade when they are approximately six years old. What can be said about these children's cognitive abilities? Piagetian theory offers two major areas of consideration: the factors responsible for cognitive development and the distinguishing characteristics of its stages, in other words, the "how" and "what" of cognitive development. Germane to the topic here, a brief summary of Piaget's theory is presented. More indepth discussion can be found in Piaget's own writing (1953, 1963) and that done in collaboration with Inhelder (1969) as well as in a number of works that represent simplified interpretations

of Piagetian theory (Flavell, 1963; Ginsburg & Opper, 1969; Furth, 1970; Pulaski, 1971; Elkind, 1974).

Regarding the "how" of development, it is important to recognize that children continually act on their world. Through exploration and activity, they derive information and ideas that are fitted into what they already know; the experiences then have sense or meaning to them. Given time and opportunity, children structure their own minds through interaction with the environment. In more technical language, children assimilate or alter information to fit their existing mental structure or schema, and they accomodate new information by forming new schema. The point is that children are not given knowledge; they construct their own knowledge.

The challenge to teachers is to provide a learning environment that encourages a continuance of children's cognitive development. Generally speaking, such an environment would foster active participation and exploration by children. They would act on stimulating materials and participate in challenging experiences, forming and testing hypotheses naturally. Such an environment, as it specifically relates to reading instruction, would expose children to a variety of reading experiences with varying materials--not just the typical instructional reading books. Children encountering print on the chalkboard, on bulletin boards, in written notes, and so forth will naturally ask questions about what it means. Their spontaneous queries would be encouraged and responded to freely. Children would be interacting and discussing with peers what has been read to them and what they have read. The method of teaching would be one of discovery with children lead to observe and draw conclusions about print rather than told what it is they should have observed and concluded. Verbalization is no substitute for active observation and exploration.

Regarding the "what" of cognitive development, one turns to Piaget's stages which represent periods of cognitive growth. While the stages are invariant, the age at which individual children pass through them varies. The stage of pre-operations is said to span the ages of four to seven, while the stage of concrete operations goes from seven until eleven. Because these ages are rough approximations, the six-year olds in first grade learning to read will vary in stages of cognitive development: some being at pre-operations, some at concrete operations, and some at a transition stage.

Attainment of concrete operations is considered a benchmark in cognitive development--marking the emergence of logical reasoning ability that is applied to concrete objects and events. Three major abilities that develop include conservation, classification, and seriation.

The conserving child, at least in reference to conservation of amount, recognizes, for example, that a round ball of clay rolled into a sausage shape has not been changed in amount. He or she is able to "conserve" in his or her mind the object's amount, in the face of a change in appearance. Such a mental task is far from simple when one considers the subprocesses involved:

1) decentration which allows focus on more than one attribute of an object at a time so that transformations in an object are noticed. In the case of the clay, there is awareness of both amount and appearance.
2) discrimination between relevant and irrelevant attributes. Appearance in the clay example is irrelevant.
3) reversibility of thought which involves working a mental change on an object and then reversing the change to arrive at the starting point. The sausage shape is mentally changed back to the ball and thus it is understood that there has been no change in amount.

Elkind (1976, p. 332) states that conservation ability is significant because it indicates reasoning ability . The conclusion that the property of amount has remained the same cannot be arrived at through visual appearance; mental reasoning is required. No clay was added or taken away from the original; therefore, there has been no change in amount.

A child at concrete operations is able to do some classification tasks that were beyond him during the pre-operational stage. At concrete operations there is some understanding of class inclusion or hierarchical classification--that some categories can be subordinate to others. For example, given five roses and two daisies and asked whether there are more flowers or more roses, the concrete operational child will answer correctly that there are more flowers because they are all flowers. In contrast, a preoperational child fails to sense the category label of flowers as applying to all seven objects. Considering just the roses and the daisies, he often says there are more roses. Inherent in a child's class inclusion ability is the function of holding superordinate and subordinate concepts in mind simultaneously--seeing part-whole relationships--and seeing that objects can exist in more than one class. Although classification growth occurs during concrete operations, it should be cautioned that classification skill is not complete until a later stage.

The ability to order objects in a sequence, to seriate, improves during concrete operations. For example, children are able to arrange sticks of varying lengths in ascending or descending order. To correctly perform this sequencing task, a child must keep in mind both the object to the left and to the right as each choice is made.

From this brief description, it should be recognized that pre-operational children are limited in not being able to conserve, classify, and seriate to the extent that concrete operational children can. But then again, children capable of concrete operational thought are limited, too. Even though they can

do in their heads what previously required direct action, they can do mental operations only on what they have directly experienced--not on what is abstract. Instructional implications stemming from stage characteristics are found in subsequent sections.

THE CONNECTION BETWEEN COGNITIVE DEVELOPMENT AND READING DEVELOPMENT

Only recently have educators turned to developmental psychology, especially to Piagetian theory, for insight into what cognitive factors may be accounting for children's success or lack of it in beginning reading. Some have begun to research in a general way the relationship between cognitive development and beginning reading. A significant summary of the research has been prepared by Waller (1977) who reviewed both correlational and comparative studies. From the correlational research, Waller concluded that there was a positive relationship between concrete operational thought and reading success, although the relationship was reduced considerably when intelligence was held constant. Of the Piagetian tasks used, seriation, rather than conservation or classification, appeared to be the highest correlate of reading performance. Of the conservation tasks, number conservation was a better correlate than other conservation tasks. From the comparative studies, it was concluded that "on the average, conservers are better readers than nonconservers, better readers are more likely to be conservers, deficient readers are deficient conservers, and early readers are early conservers" (p.23). However, according to Waller, these conclusions are tentative and are limited because they do not indicate a causal relationship.

The research, therefore, indicates some relationship between cognitive development and beginning reading--suggesting the fruitfulness of further pursuit into the specific points of connection. Research into the specifics has been minimal. Such research certainly will not be easy because the reading field, as pointed out by Kinsbourne (1976), does not have a validated model of

beginning reading. A possible procedure that would have face validity would be to logically determine what tasks are required in beginning reading and what cognitive operations appear to be involved in those tasks (p. 143). Such a procedure is followed below. Beginning reading is viewed as requiring 1) a concept of reading and concepts about written language, 2) decoding strategies, 3) vocabulary and concept understanding, and 4) comprehension strategies.

Concepts of Reading and Written Language

It is important for beginning readers to be aware of the meaning aspect of print, which permits an understanding of the purpose of reading. The squiggle marks on a page symbolize meanings, and the reason people read is to derive the meaning in the author's message. There also is a sound aspect of print which is relevant to decoding. Printed letters and words represent the sounds of oral language. Awareness of how oral language is related to the printed forms of written language involves awareness of language segments such as phoneme, letter, word, and sentence.

The research thus far on children's understanding of the purpose and nature of written language indicates considerable confusion. The work of Downing (1969), Downing and Oliver (1973-74), and Reid (1966) indicates that young children often do not know the reason for reading. They often cannot distinguish between letters, words, and sentences. The confusion may be due not only to lack of metalinguistic awareness but a cognitive failure to see part-whole relationships, which is a basic to the development of concepts about language. Such confusion obviously affects the degree to which children profit from phonics instruction.

To help children see the purpose of reading, teachers should read to children often and discuss with them the ideas they have derived. The language experience approach, wherein children dictate their own reading material, may be used because in that process children see that their ideas can be represented

in written form, and through the written medium others can learn of their ideas. Particularly significant to children are these experiences in which they dictate, and later write, messages to one another. In addition, we ought not assume children understand the basic language terminology we use rather unthinkingly. Such terms as letter, word, and sentence, important in instructional communication, require teaching and reinforcement.

Decoding

When analyzing the decoding instruction provided children, it becomes apparent that many tasks are perceptually and cognitively quite demanding, especially if a child is at the pre-operational stage. Visual discrimination and visual memory require perceptual consideration of several print features and the abstraction of those features that are distinctive. Learning the sounds associated with letters involves learning multiple correspondences. As letter chunks are focused on in decoding, the reader must be aware of part-whole relationships. And throughout the development of decoding strategies, seriation is required. Regardless of the language units being processed, the reader generally follows a left-to-right sequence.

The implications for teachers include alerting children to the graphic features that distinguish two particularly confusing letters, groups of letters, or words. Durkin (1976), pp. 259-260) suggests putting two confusing words, one above the other, and leading children in a left-to-right manner through the word to observe which letters are different. As far as teaching the multiple sounds associated with a given letter, controversy exists. Williams (1968) has evidence indicating that concurrent presentation of multiple sounds is more effective than successive presentation because it develops what Levin calls a "set for diversity" (1963). Williams concludes, however, that teachers should explore both types of presentation because some children may be overwhelmed with too much diversity during initial teaching.

The wording of teacher directions and explanations regarding decoding are worth examination. It was in the wording of instruction contained in teacher manuals that MacGintie (1976) found undue complexity. It would seem important that teachers note students' responses to explanations and attempt simplification to reduce the elements to be kept in memory at one time and thereby decrease instructional confusion.

Phonics instruction typically is fraught with the teaching of rules. Concrete operational capability represents the beginning of rule understanding. One would then question the value of teaching such rules to pre-operational children. They may be able to apply rote memory to the task, but it is likely that understanding as well as application ability would be lacking. It should also be cautioned that concrete operational children do not necessarily understand all rules. Some language rules are more complex and abstract than others. When teaching rules, Gibson and Levin (1975) suggest that teachers, rather than simply telling the rule, use a discovery approach because such an approach is compatible with Piaget's notion of assimilation (pp. 69-70).

Vocabulary and Concepts

Knowing the meanings of vocabulary is important to reading comprehension. The stage of concrete operations represents vocabulary and conceptual growth over the stage of pre-operations. For example, concrete operational children understand better the difference between a word and its referent, recognize that word names are arbitrary, and understand that words can have multiple meanings (Elkind 1974).

Despite new vocabulary awareness, limitations are evident when concrete operational children are compared with proficient readers. First, knowing a word in a mature way means having a complete concept for it. As presented in the model of Frayer, Frederick, and Klausmeier (1969, pp. 5-6), knowing a concept involves knowing its superordinate, coordinate, and subordinate concepts.

Knowing "dog" for example, means knowing, respectively, "animal", "cat", and "Great Dane". As revealed in the research of Feifel and Lorge (1950), it is this type of categorizing definition that older elementary children are inclined to give when asked to tell the meaning of a particular word. Young children, on the other hand, give descriptions and uses for the word rather than the category to which it belongs. When asked what an orange is, older children tend to say it is a fruit whereas young children tend to say "it's round" or "you eat it." A second difference between beginning readers and older students is the type of words they readily understand. Concrete operational children find it easier to understand words having a concrete referent like the word carnival rather than words of an abstract nature like integrity. A third difference relates to the breadth of children's concepts. Saltz and Siegel (1967) found that six-year-old children are prone to concept overdiscrimination--thereby forming very narrow concepts. With increase in age children broaden their categories to include more and more instances.

Because of young children's approach to vocabulary and concept learning, it is important for teachers to make vocabulary teaching as concrete as possible--both concrete objects and illustrations help. The category into which a concept fits as well as its relevant features and some examples should be presented, in language children understand, so that full concepts are acquired. Many encounters with specific words are helpful because repeated exposure to words in different contexts contributes to vocabulary clarity and flexibility. The words should also be encountered within various communication modes. Words are deeply internalized when they are heard and read and when children use them in speaking and writing.

Comprehension

Comprehension, according to Smith (1975), is relating information to one's cognitive structure. Thus the child's cognitive framework and cognitive abilities

affect the degree to which meaning is drawn from the page. The aspects of comprehension discussed below are: experiential background, making inferences, understanding figurative expression, understanding humor, and being alert to overall structure. Some aspects appear to be more related to cognitive development that others.

Experiential background. An obvious connection between cognitive development and comprehension is that story material not in the realm of children's direct experience will constitute difficulty because of its abstract nature. The importance of material to which children can relate is a rationale for using the language experience approach in beginning reading. When material not written by the children themselves is used, as in the basal approach, it should be examined carefully. In some cases it may be decided to not use the material and in other cases to prepare students for reading by developing their background of experience.

Inference. One point that appears supported by the research is that young children can and do infer when reading, a finding which suggests that inference may not be as strongly related to cognitive development as some of the other factors. Prawat, Cancelli, and Cook (1976) tested children in kindergarten, grade two, and grade four on their ability to recall sentences presented orally. Both kindergartners and second graders erred in saying that true inference statements were in fact given in the task, indicating the process of constructive memory. Working with young children in reading, teachers should keep in mind that inference is not beyond these children and should be encouraged.

Understanding figurative expression. Children encounter considerable amounts of literary material in beginning reading, and within that material figurative language is often present. One type of figurative expression is

the metaphor which describes one aspect of an object or situation through uncommon comparison to another realm of experience. Winner, Rosenstiel and Gardner (1976) studied children aged six to fourteen on their understanding of a variety of metaphors. What were considered as genuine metaphors, like "The prison guard was a hard rock," which call for an association between the physical and psychological realms, were not understood until age ten. Considering metaphor comprehension a type of classification behavior, Billow (1975) found significant improvement between the ages of five and seven. It should be pointed out, however, that the five-year-olds did surprisingly well--indicating that some figurative sense develops early. But the nature of young children's figurative understanding needs elaboration. The researchers found that they were using intuitive thought rather than operational reasoning in their interpretations. As children passed seven years of age, their explanations of what metaphors meant reflected a decline in intuition and an increase in operational thinking.

Humor. Teachers know that children have comprehended when they chuckle over funny stories, poems, and riddles. Comprehension requires understanding and appreciation of humor. The results of the research of Whitt and Prentice (1977) indicates that first grade children's comprehension and enjoyment of joking riddles of the homonymic type, like "Why are fish smart? They go around in schools," was significantly related to the stage of conservation ability. In the research of McGhee (1974) one of the tasks was to identify which of two versions of a joke was funnier and why. A sharp increase in discriminability with absurdity jokes, of the elephant type, was found between grades one and two--presumabably between pre-operations and concrete operations.

Overall structure. The quality of what is reconstructed during the act of reading is significant. Is the reader garnering what is relevant? Is the

reader able to come away with the central ideas? Christie and Schumacher (1975) had children in kindergarten, grade two and grade five listen to and recall a passage. At all levels, even kindergarten, more relevant than irrelevant information was recalled. Although the total amount of relevant information kindergartners recalled was lower than for the other two grades, they appeared to be focusing on the relevant ideas. The researchers suggest that the young children were swept up with the events of the plot and thus recalled them in logical sequence.

It appears that in the realm of story structure children have particular strengths. In the research of Mandler and Johnson (1977), first graders, fourth graders, and adults heard and recalled stories. Although the memory of the first graders was not as good as that of the fourth graders, the young children did evidence awareness of story organization. For example, they recalled settings, beginnings, and outcomes. Not as well recalled were attempts in the plot, the final ending of the story, and the internal reactions of the characters--but the adults, too, found endings and reactions hardest to recall. The researchers concluded that young children were alert to story structure and had a scheme for memory that was similar to that of adults.

Discussion of the quality of what is comprehended would be incomplete without some attention to the traditional notion of "main idea." One might hypothesize that children having attained concrete operations would find it easy to determine the main idea because they would have the requisite abilities of keeping in mind a number of ideas simultaneously and creating a category into which the ideas apply. Such was not the case with third graders in the research of Kretschmer (1975). He found that when asked to think of a main idea for a short paragraph, children focused on a single element rather than determining a gestalt. Apparently, ability to focus on several aspects of

a concrete object, does not guarantee comparable ability with written language.

To summarize, there are a number of comprehension tasks involved in beginning reading that on the basis of logic appear to be affected by cognitive factors. The question is whether or not these factors are dependent on cognitive development--dependent on whether children have reached concrete operations. The answer is: it appears that some are and some aren't, and there are some in between because although they appear in pre-operational children, their form becomes more mature in subsequent stages. This conclusion, which is hazy indeed, is made hazier when its prematurity is underscored. First, the number of relevant studies is sparse. Second, in many of the studies children were not actually tested for concrete operations or pre-operations; rather the assumption of stage was made solely on the basis of age. Third, most of the research attempting to show a differentiation in ability on the basis of cognitive stage did not directly involve reading--most often response was made to pictures or to oral language. When reading was examined, as in Kretschmer's research (1975), it was found that even concrete operational children could not perform comprehension tasks one might reason would be within their repertoire. Just because children can do a process when the task is concrete does not mean children can follow the same process with written language. Written language may be presenting difficulty because it represents the ideas someone else derives from concrete experience. According to Moffett and Wagner (1976,p.8), it is one thing to abstract from experience directly and quite another to abstract from someone else's abstraction.

IMPLICATIONS FOR TEACHING CONCLUDED

The above discussion and research point out a general relationship between concrete operational thinking and beginning reading success and allude to some specific connections. Is the implication, then, that reading instruction should

not be given to pre-operational children? The situation is not that simple. Children having pre-operational thought possess a number of cognitive skills involved in beginning reading; they have some classification ability, some metaphor understanding, and some sensitivity to story structure. Moreover, there appears to be some positive evidence that features of a particular cognitive stage can be taught (Roberts, 1976) provided that children are relatively close to making the transition to a new stage (Inhelder and Sinclair, 1969) and that verbal methods are not the means of instruction (Sinclair de-Zwart, 1969). Concrete experiences having structure appear to be crucial. Should it be concluded that concrete operational children will have no difficulty with beginning reading instruction? The answer is 'no' because they are limited to the realm of the concrete and their ability to apply cognitive processes to the reading task remains a question.

Perhaps the biggest implication stemming from a consideration of cognitive development is in the realm of how the teaching-learning situation is approached by the teacher. Teachers who have a Piagetian framework recognize individual differences in children's cognitive development and understand that learning will be gradual, with many experiences required for mastery. They learn about individual abilities by listening to children's responses and by asking them questions about how answers were arrived at. They use the information gathered about individuals when deciding on appropriate instructional materials, procedures, and explanations. When teachers help children develop new cognitive strategies, they experiment with various procedures to structure the situation, recognizing that what children are incapable of doing on their own may be within their grasp with some structure. The use of discovery procedures with concrete materials is especially useful. In short, teachers are attune to the cognitive dimension in beginning reading tasks, with that sensitivity understand student difficulty, and take steps to

improve children's learning opportunities.

IMPLICATIONS FOR RESEARCH

Before curricular and instructional implications can be more firmly drawn, considerably more research is needed. We need to know how cognitive stage influences reading tasks--rather than listening tasks or tasks with concrete objects. We need to get specific about which aspects of the reading process are most related to cognitive development--especially comprehension which has been largely unexplored. Once specific relationships are established we can ask a number of questions. Are the relationships causal ones? Can children be taught these basic cognitive strategies with subsequent improvement in reading performance? Are these cognitive factors sufficiently predictive to be used in reading readiness and early identification screening? How might a model of beginning reading be characterized when cognitive development is brought into focus? The intersection of cognitive development and beginning reading is a topic that invites creative investigation.

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